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Ada COMPILER

VALIDATION SUMMARY REPORT:

Certificate Number: 910502S1.11159

DDC International A/S

DACS Sun-3/SunOS to 68030 Bare Ada Cross Compiler System,  
Version 4.6.4, MRI IEEE 695 (BASIC\_MODE)  
Sun-3/50 => Motorola MVME143 Board (68030/68882)

Prepared By:

Software Standards Validation Group  
National Computer Systems Laboratory  
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AVF Control Number: NIST90DDC500\_11\_1.11

Certificate Information

The following Ada implementation was tested and determined to pass ACVC 1.11. Testing was completed on May 2, 1991.

Compiler Name and Version: DACS Sun-3/SunOS to 68030 Bare Ada Cross Compiler System, Version 4.6.4, MRI IEEE 695 (BASIC\_MODE)

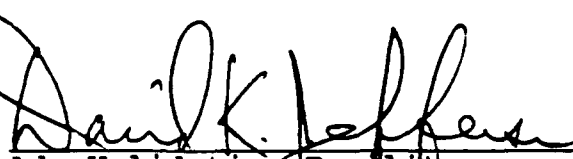
Host Computer System: Sun-3/50 running SunOS Release 4.0\_Export

Target Computer System: Motorola MVME143 Board (68030/68882)

A more detailed description of this Ada implementation is found in section 3.1 of this report.

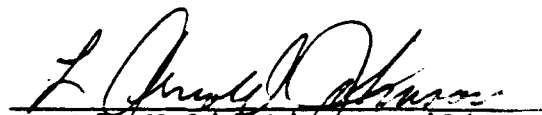
As a result of this validation effort, Validation Certificate 910502S1.11159 is awarded to DDC International A/S. This certificate expires on March 01, 1993.

This report has been reviewed and is approved.



Ada Validation Facility  
Dr. David K. Jefferson  
Chief, Information Systems  
Engineering Division (ISED)

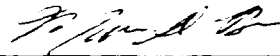
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DECLARATION OF CONFORMANCE

The following declaration of conformance was supplied by the customer.

DECLARATION OF CONFORMANCE

Customer and Certificate Awardee: DDC International A/S

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Technology  
Computer Systems Laboratory (CSL)  
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Building 225, Room A266  
Gaithersburg, Maryland 20899

ACVC Version: 1.11

Ada Implementation:

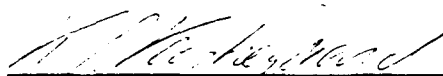
Compiler Name and Version: DACS Sun-3/SunOS to 68030 Bare Ada  
Cross Compiler System, Version  
4.6.4, MRI IEEE 695 (BASIC\_MODE)

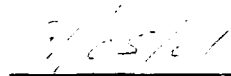
Host Computer System: Sun-3/50 running SunOS Release  
4.0\_Export

Target Computer System: Motorola MVME143 Board (68030/68882)

Declaration:

I the undersigned, declare that I have no knowledge of deliberate deviations from the Ada Language Standard ANSI/MIL-STD-1815A ISO 8652-1987 in the implementation listed above.

  
\_\_\_\_\_  
Customer Signature  
Company DDC International A/S  
Title Project Manager

  
\_\_\_\_\_  
Date

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## CHAPTER 1

### INTRODUCTION

The Ada implementation described above was tested according to the Ada Validation Procedures [Pro90] against the Ada Standard [Ada83] using the current Ada Compiler Validation Capability (ACVC). This Validation Summary Report (VSR) gives an account of the testing of this Ada implementation. For any technical terms used in this report, the reader is referred to [Pro90]. A detailed description of the ACVC may be found in the current ACVC User's Guide [UG89].

#### 1.1 USE OF THIS VALIDATION SUMMARY REPORT

Consistent with the national laws of the originating country, the Ada Certification Body may make full and free public disclosure of this report. In the United States, this is provided in accordance with the "Freedom of Information Act" (5 U.S.C. #552). The results of this validation apply only to the computers, operating systems, and compiler versions identified in this report.

The organizations represented on the signature page of this report do not represent or warrant that all statements set forth in this report are accurate and complete, or that the subject implementation has no nonconformities to the Ada Standard other than those presented. Copies of this report are available to the public from the AVF which performed this validation or from:

National Technical Information Service  
5285 Port Royal Road  
Springfield VA 22161

Questions regarding this report or the validation test results should be directed to the AVF which performed this validation or to:

Ada Validation Organization  
Institute for Defense Analyses  
1801 North Beauregard Street  
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#### 1.2 REFERENCES

- [Ada83] Reference Manual for the Ada Programming Language, ANSI/MIL-STD-1815A, February 1983 and ISO 8652-1987.
- [Pro90] Ada Compiler Validation Procedures, Version 2.1, Ada Joint Program Office, August 1990.

### 1.3 ACVC TEST CLASSES

Compliance of Ada implementations is tested by means of the ACVC. The ACVC contains a collection of test programs structured into six test classes: A, B, C, D, E, and L. The first letter of a test name identifies the class to which it belongs. Class A, C, D, and E tests are executable. Class B and class L tests are expected to produce errors at compile time and link time, respectively.

The executable tests are written in a self-checking manner and produce a PASSED, FAILED, or NOT APPLICABLE message indicating the result when they are executed. Three Ada library units, the packages REPORT and SPRT13, and the procedure CHECK\_FILE are used for this purpose. The package REPORT also provides a set of identity functions used to defeat some compiler optimizations allowed by the Ada Standard that would circumvent a test objective. The package SPRT13 is used by many tests for Chapter 13 of the Ada Standard. The procedure CHECK\_FILE is used to check the contents of text files written by some of the Class C tests for Chapter 14 of the Ada Standard. The operation of REPORT and CHECK\_FILE is checked by a set of executable tests. If these units are not operating correctly, validation testing is discontinued. Class B tests check that a compiler detects illegal language usage. Class B tests are not executable. Each test in this class is compiled and the resulting compilation listing is examined to verify that all violations of the Ada Standard are detected. Some of the class B tests contain legal Ada code which must not be flagged illegal by the compiler. This behavior is also verified.

Class L tests check that an Ada implementation correctly detects violation of the Ada Standard involving multiple, separately compiled units. Errors are expected at link time, and execution is attempted.

In some tests of the ACVC, certain macro strings have to be replaced by implementation-specific values -- for example, the largest integer. A list of the values used for this implementation is provided in Appendix A. In addition to these anticipated test modifications, additional changes may be required to remove unforeseen conflicts between the tests and implementation-dependent characteristics. The modifications required for this implementation are described in section 2.3.

For each Ada implementation, a customized test suite is produced by the AVF. This customization consists of making the modifications described in the preceding paragraph, removing withdrawn tests (see section 2.1) and, possibly some inapplicable tests (see Section 3.2 and [UG89]).

In order to pass an ACVC an Ada implementation must process each test of the ~~the~~ customized test suite according to the Ada Standard.

#### 1.4 DEFINITION OF TERMS

Ada Compiler	The software and any needed hardware that have to be added to a given host and target computer system to allow transformation of Ada programs into executable form and execution thereof.
Ada Compiler Validation Capability (ACVC)	The means for testing compliance of Ada implementations, Validation consisting of the test suite, the support programs, the ACVC Capability user's guide and the template for the validation summary (ACVC) report.
Ada Implementation	An Ada compiler with its host computer system and its target computer system.
Ada Validation Facility (AVF)	The part of the certification body which carries out the procedures required to establish the compliance of an Ada implementation.
Ada Validation Organization (AVO)	The part of the certification body that provides technical guidance for operations of the Ada certification system.
Compliance of an Ada Implementation	The ability of the implementation to pass an ACVC version.
Computer System	A functional unit, consisting of one or more computers and associated software, that uses common storage for all or part of a program and also for all or part of the data necessary for the execution of the program; executes user-written or user-designated programs; performs user-designated data manipulation, including arithmetic operations and logic operations; and that can execute programs that modify themselves during execution. A computer system may be a stand-alone unit or may consist of several inter-connected units.
Conformity	Fulfillment by a product, process or service of all requirements specified.
Customer	An individual or corporate entity who enters into an agreement with an AVF which specifies the terms and conditions for AVF services (of any kind) to



be performed.

Declaration of Conformance	A formal statement from a customer assuring that conformity is realized or attainable on the Ada implementation for which validation status is realized.
Host Computer System	A computer system where Ada source programs are transformed into executable form.
Inapplicable test	A test that contains one or more test objectives found to be irrelevant for the given Ada implementation.
Operating System	Software that controls the execution of programs and that provides services such as resource allocation, scheduling, input/output control, and data management. Usually, operating systems are predominantly software, but partial or complete hardware implementations are possible.
Target Computer System	A computer system where the executable form of Ada programs are executed.
Validated Ada Compiler	The compiler of a validated Ada implementation.
Validated Ada Implementation	An Ada implementation that has been validated successfully either by AVF testing or by registration [Pro90].
Validation	The process of checking the conformity of an Ada compiler to the Ada programming language and of issuing a certificate for this implementation.
Withdrawn test	A test found to be incorrect and not used in conformity testing. A test may be incorrect because it has an invalid test objective, fails to meet its test objective, or contains erroneous or illegal use of the Ada programming language.

## CHAPTER 2

### IMPLEMENTATION DEPENDENCIES

#### 2.1 WITHDRAWN TESTS

Some tests are withdrawn by the AVO from the ACVC because they do not conform to the Ada Standard. The following 93 tests had been withdrawn by the Ada Validation Organization (AVO) at the time of validation testing. The rationale for withdrawing each test is available from either the AVO or the AVF. The publication date for this list of withdrawn tests is 91-03-14.

E28005C	B28006C	C34006D	C35508I	C35508J	C35508M
C35508N	C35702A	C35702B	B41308B	C43004A	C45114A
C45346A	C45612A	C45612B	C45612C	C45651A	C46022A
B49008A	A74006A	C74308A	B83022B	B83022H	B83025B
B83025D	B83026B	C83026A	C83041A	B85001L	C86001F
C94021A	C97116A	C98003B	BA2011A	CB7001A	CB7001B
CB7004A	CC1223A	BC1226A	CC1226B	BC3009B	BD1B02B
BD1B06A	AD1B08A	BD2A02A	CD2A21E	CD2A23E	CD2A32A
CD2A41A	CD2A41E	CD2A87A	CD2B15C	BD3006A	BD4008A
CD4022A	CD4022D	CD4024B	CD4024C	CD4024D	CD4031A
CD4051D	CD5111A	CD7004C	ED7005D	CD7005E	AD7006A
CD7006E	AD7201A	AD7201E	CD7204B	AD7206A	BD8002A
BD8004C	CD9005A	CD9005B	CDA201E	CE2107I	CE2117A
CE2117B	CE2119B	CE2205B	CE2405A	CE3111C	CE3116A
CE3118A	CE3411B	CE3412B	CE3607B	CE3607C	CE3607D
CE3812A	CE3814A	CE3902B			

#### 2.2 INAPPLICABLE TESTS

A test is inapplicable if it contains test objectives which are irrelevant for a given Ada implementation. The inapplicability criteria for some tests are explained in documents issued by ISO and the AJPO known as Ada Issues and commonly referenced in the format AI-dddd. For this implementation, the following tests were inapplicable for the reasons indicated; references to Ada Issues are included as appropriate.

The following 201 tests have floating-point type declarations requiring more digits than SYSTEM.MAX\_DIGITS:

C24113L..Y (14 tests)	C35705L..Y (14 tests)
C35706L..Y (14 tests)	C35707L..Y (14 tests)
C35708L..Y (14 tests)	C35802L..Z (15 tests)
C45241L..Y (14 tests)	C45321L..Y (14 tests)

C45421L..Y (14 tests)	C45521L..Z (15 tests)
C45524L..Z (15 tests)	C45621L..Z (15 tests)
C45641L..Y (14 tests)	C46012L..Z (15 tests)

C24113I..K (3 TESTS) USE A LINE LENGTH IN THE INPUT FILE WHICH EXCEEDS 126 CHARACTERS.

THE FOLLOWING 20 TESTS CHECK FOR THE PREDEFINED TYPE LONG\_INTEGER:

C35404C	C45231C	C45304C	C45411C	C45412C
C45502C	C45503C	C45504C	C45504F	C45611C
C45613C	C45614C	C45631C	C45632C	B52004D
C55B07A	B55B09C	B86001W	C86006C	CD7101F

C35404D, C45231D, B86001X, C86006E, AND CD7101G CHECK FOR A PREDEFINED INTEGER TYPE WITH A NAME OTHER THAN INTEGER, LONG\_INTEGER, OR SHORT\_INTEGER

C35713B, C45423B, B86001T, AND C86006H CHECK FOR THE PREDEFINED TYPE SHORT\_FLOAT.

C35713D AND B86001Z CHECK FOR A PREDEFINED FLOATING-POINT TYPE WITH A NAME OTHER THAN FLOAT, LONG\_FLOAT, OR SHORT\_FLOAT.

C45531M, C45531N, C45531O, C45531P, C45532M, C45532N, C45532O, AND C45532P CHECK FIXED-POINT OPERATIONS FOR TYPES THAT REQUIRE A SYSTEM.MAX\_MANTISSA OF 47 OR GREATER.

C45624A AND C45624B CHECK THAT THE PROPER EXCEPTION IS RAISED IF MACHINE\_OVERFLOW'S IS FALSE FOR FLOATING-POINT TYPES; FOR THIS IMPLEMENTATION, MACHINE\_OVERFLOW'S IS TRUE.

C4A013B CONTAINS THE EVALUATION OF AN EXPRESSION INVOLVING MACHINE\_RADIX APPLIED TO THE MOST PRECISE FLOATING-POINT TYPE. THIS EXPRESSION WOULD RAISE AN EXCEPTION. SINCE THE EXPRESSION MUST BE STATIC, IT IS REJECTED AT COMPILE TIME.

B86001Y CHECKS FOR A PREDEFINED FIXED-POINT TYPE OTHER THAN DURATION.

C96005B CHECKS FOR VALUES OF TYPE DURATION'BASE THAT ARE OUTSIDE THE RANGE OF DURATION. THERE ARE NO SUCH VALUES FOR THIS IMPLEMENTATION.

CA2009C AND CA2009F CHECK WHETHER A GENERIC UNIT CAN BE INSTANTIATED BEFORE ITS BODY (AND ANY OF ITS SUBUNITS) IS COMPILED; THIS IMPLEMENTATION CREATES A DEPENDENCE ON GENERIC UNITS AS ALLOWED BY AI-00408 AND AI-00506 SUCH THAT THE COMPILATION OF THE GENERIC UNIT BODIES MAKES THE INSTANTIATING UNITS OBSOLETE. (SEE SECTION 2.3.)

CD1009C ~~USES~~ A REPRESENTATION CLAUSE SPECIFYING A NON-DEFAULT SIZE FOR A FLOATING-POINT TYPE.

CD2A84A, CD2A84E, CD2A84I..J (2 TESTS), AND CD2A84O USE REPRESENTATION CLAUSES SPECIFYING NON-DEFAULT SIZES FOR ACCESS TYPES.

THE FOLLOWING 264 TESTS CHECK FOR SEQUENTIAL, TEXT, AND DIRECT ACCESS FILES:

CE2102A..C (3)	CE2102G..H (2)	CE2102K	CE2102N..Y (12)
CE2103C..D (2)	CE2104A..D (4)	CE2105A..B (2)	CE2106A..B (2)
CE2107A..H (8)	CE2107L	CE2108A..H (3)	CE2109A..C (3)
CE2110A..D (4)	CE2111A..I (9)	CE2115A..B (2)	
CE2120A..B (2)	CE2201A..C (3)	EE2201D..E (2)	CE2201F..N (9)
CE2203A	CE2204A..D (4)	CE2205A	CE2206A
CE2208B	CE2401A..C (3)	EE2401D	CE2401E..F (2)
EE2401G	CE2401H..L (5)	CE2403A	CE2404A..B (2)
CE2405B	CE2406A	CE2407A..B (2)	CE2408A..B (2)
CE2409A..B (2)	CE2410A..B (2)	CE2411A	CE3102A..C (3)
CE3102F..H (3)	CE3102J..K (2)	CE3103A	CE3104A..C (3)
CE3106A..B (2)	CE3107B	CE3108A..B (2)	CE3109A
CE3110A	CE3111A..B (2)	CE3111D..E (2)	CE3112A..D (4)
CE3114A..B (2)	CE3115A	CE3119A	
EE3203A	EE3204A	CE3207A	CE3208A
CE3301A	EE3301B	CE3302A	CE3304A
CE3305A	CE3401A	CE3402A	EE3402B
CE3402C..D (2)	CE3403A..C (3)	CE3403E..F (2)	CE3404B..D (3)
CE3405A	EE3405B	CE3405C..D (2)	CE3406A..D (4)
CE3407A..C (3)	CE3408A..C (3)	CE3409A	CE3409C..E (3)
EE3409F	CE3410A	CE3410C..E (3)	EE3410F
CE3411A	CE3411C	CE3412A	EE3412C
CE3413A..C (3)	CE3414A	CE3602A..D (4)	CE3603A
CE3604A..B (2)	CE3605A..E (5)	CE3606A..B (2)	
CE3704A..F (6)	CE3704M..O (3)	CE3705A..E (5)	CE3706D
CE3706F..G (2)	CE3804A..P (16)	CE3805A..B (2)	CE3806A..B (2)
CE3806D..E (2)	CE3806G..H (2)	CE3904A..B (2)	CE3905A..C (3)
CE3905L	CE3906A..C (3)	CE3906E..F (2)	

CE2103A..B AND CE3107A EXPECT THAT NAME\_ERROR IS RAISED WHEN AN ATTEMPT IS MADE TO CREATE A FILE WITH AN ILLEGAL NAME; THIS IMPLEMENTATION DOES NOT SUPPORT THE CREATION OF EXTERNAL FILES AND SO RAISES USE\_ERROR. (See section 2.3.)

## 2.3 TEST MODIFICATIONS

Modifications (see section 1.3) were required for 70 tests.

The following tests were split into two or more tests because this implementation did not report the violations of the Ada Standard in the way expected by the original tests.

B22003A	B26001A	B26002A	B26005A	B28003A	B29001A	B33301B
B35101A	B37106A	B37301B	B37302A	B38003A	B38003B	B38009A
B38009B	B55A01A	B61001C	B61001F	B61001H	B61001I	B61001M
B61001R	B61001W	B67001H	B83A07A	B83A07B	B83A07C	B83E01C
B83E01D	B83E01E	B85001D	B85008D	B91001A	B91002A	B91002B
B91002C	B91002D	B91002E	B91002F	B91002G	B91002H	B91002I
B91002J	B91002K	B91002L	B95030A	B95061A	B95061F	B95061G
B95077A	B97103E	B97104G	BA1001A	BA1101B	BC1109A	BC1109C
BC1109D	BC1202A	BC1202F	BC1202G	BE2210A	BE2413A	

"PRAGMA ELABORATE (REPORT)" has been added at appropriate points in order to solve the elaboration problems for:

C83030C C86007A

BC3204C and BC3205D were graded passed by Processing Modification as directed by the AVO. These tests check that instantiations of generic units with unconstrained types as generic actual parameters are illegal if the generic bodies contain uses of the types that require a constraint. However, the generic bodies are compiled after the units that contain the instantiations, and this implementation creates a dependence of the instantiating units on the generic units as allowed by AI-00408 and AI-00506 such that the compilation of the generic bodies makes the instantiating units obsolete--no errors are detected. The processing of these tests was modified by re-compiling the obsolete units; all intended errors were then detected by the compiler.

The value used to specify the collection size has been increased from 256 to 324 take alignment into account for:

CD2A83A

CE2103A..B and CE3107A abort with an unhandled exception when USE\_ERROR is raised on the attempt to create an external file (see 2.2). The AVO ruled that these tests are to be graded as inapplicable.

## CHAPTER 3

### PROCESSING INFORMATION

#### 3.1 TESTING ENVIRONMENT

The executable files were prepared on the Sun-3/50 host computer. The target linker used was developed by Microtech Research Inc. and is called "lnk68k". The linker produces an S-record format module that prior to being loaded is packed by a DDC-I developed tool. The executables were transferred via an RS232 serial line from the Sun-3/50 (host) to the Motorola MVME143 Board (68030/68882) (target); this RS232 line is used by a downloader on the host for communication with the monitor on the target. The serial RS232 line is also used for communication between the Ada program running on the target board for TEXT\_IO communication with the downloader on the host which captures the output.

The DACS Sun-3/SunOS to 68030 Bare Ada Cross Compiler System, Version 4.6.4, MRI IEEE 695 (BASIC\_MODE) was executed on the target board with the following:

- Motorola MVME143 Board (68030/68882)
- One internal timer
- One serial port
- 4MB RAM

For each category, a command file was generated that loaded and executed every program.

For a point of contact for technical information about this Ada implementation system, see:

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Testing of this Ada implementation was conducted at the customer's site by a validation team from the AVF.

### 3.2 SUMMARY OF TEST RESULTS

An Ada Implementation passes a given ACVC version if it processes each test of the customized test suite in accordance with the Ada Programming Language Standard, whether the test is applicable or inapplicable; otherwise, the Ada Implementation fails the ACVC [Pro90].

For all processed tests (inapplicable and applicable), a result was obtained that conforms to the Ada Programming Language Standard.

a) Total Number of Applicable Tests	3554	
b) Total Number of Withdrawn Tests	93	
c) Processed Inapplicable Tests	523	
d) Non-Processed I/O Tests	0	
e) Non-Processed Floating-Point Precision Tests	0	
f) Total Number of Inapplicable Tests	523	(c+d+e)
g) Total Number of Tests for ACVC 1.11	4170	(a+b+f)

### 3.3 TEST EXECUTION

Version 1.11 of the ACVC comprises 4170 tests. When this compiler was tested, the tests listed in section 2.1 had been withdrawn because of test errors. The AVF determined that 523 tests were inapplicable to this implementation. All inapplicable tests were processed during validation testing. In addition, the modified tests mentioned in section 2.3 were also processed.

A magnetic tape containing the customized test suite (see section 1.3) was taken on-site by the validation team for processing. The tests were compiled and linked on the host computer system, as appropriate. The executable images were transferred to the target computer system by the communications link described above, and run. The results were captured on the host computer system using the communications link described above.

Testing was performed using command scripts provided by the customer and reviewed by the validation team. See Appendix B for a complete listing of the processing options for this implementation. It also indicates the default options. The options invoked explicitly for validation testing during this test were:

```
-L -a <library>
```

There were NO compiler options invoked by default for validation testing during this test.

The specific linker options invoked for the BASIC\_MODE were:

```
-m stack_size=200000  
-t 30  
-u ../dacs/Ada_UCC.slb
```



-a acvc.alb  
      

Test output, compiler and linker listings, and job logs were captured on magnetic tape and archived at the AVF. Selected listings examined on-site by the validation team were also archived.

## APPENDIX A

### MACRO PARAMETERS

This appendix contains the macro parameters used for customizing the ACVC. The meaning and purpose of these parameters are explained in [UG89]. The parameter values are presented in two tables. The first table lists the values that are defined in terms of the maximum input-line length, which is 126 the value for \$MAX\_IN\_LEN--also listed here. These values are expressed here as Ada string aggregates, where "V" represents the maximum input-line length.

Macro Parameter	Macro Value
\$MAX_IN_LEN	126
\$BIG_ID1	(1..V-1 => 'A', V => '1')
\$BIG_ID2	(1..V-1 => 'A', V => '2')
\$BIG_ID3	(1..V/2 => 'A') & '3' & (1..V-1-V/2 => 'A')
\$BIG_ID4	(1..V/2 => 'A') & '4' & (1..V-1-V/2 => 'A')
\$BIG_INT_LIT	(1..V-3 => '0') & "298"
\$BIG_REAL_LIT	(1..V-5 => '0') & "690.0"
\$BIG_STRING1	'"' & (1..V/2 => 'A') & '"'
\$BIG_STRING2	'"' & (1..V-1-V/2 => 'A') & '1' & '"'
\$BLANKS	(1..V-20 => ' ')
\$MAX_LEN_INT_BASED_LITERAL	"2:" & (1..V-5 => '0') & "11:"
\$MAX_LEN_REAL_BASED_LITERAL	"16:" & (1..V-7 => '0') & "F.E:"
\$MAX_STRING_LITERAL	'"' & (1..V-2 => 'A') & '"'

The following table contains the values for the remaining macro parameters.

Macro Parameter	Macro Value
ACC_SIZE	: 32
ALIGNMENT	: 4
COUNT_LAST	: 2_147_483_647
DEFAULT_MEM_SIZE	: 2#1#E32
DEFAULT_STOR_UNIT	: 8
DEFAULT_SIS_NAME	: DACS_680X0
DELTA_DOC	: 2#1.0#E-31
ENTRY_ADDRESS	: FCNDECL.ENTRY_ADDRESS
ENTRY_ADDRESS1	: FCNDECL.ENTRY_ADDRESS1
ENTRY_ADDRESS2	: FCNDECL.ENTRY_ADDRESS2
FIELD_LAST	: 35
FILE_TERMINATOR	: ' '
FIXED_NAME	: NO_SUCH_TYPE
FLOAT_NAME	: NO_SUCH_TYPE
FORM_STRING	: ""
FORM_STRING2	: "CANNOT RESTRICT_FILE_CAPACITY"
GREATER_THAN_DURATION	: 100000.0
GREATER_THAN_DURATION_BASE_LAST	: 200000.0
GREATER_THAN_FLOAT_BASE_LAST	: 16#1.0#E+32
GREATER_THAN_FLOAT_SAFE_LARGE	: 16#5.FFFF_F0#E+31
GREATER_THAN_SHORT_FLOAT_SAFE_LARGE	: 16#5.FFFF_F0#E+31
HIGH_PRIORITY	: 24
ILLEGAL_EXTERNAL_FILE_NAME1	: /NODIRECTORY1/NOFILENAME1
ILLEGAL_EXTERNAL_FILE_NAME2	: /NODIRECTORY2/NOFILENAME2
INAPPROPRIATE_LINE_LENGTH	: -1
INAPPROPRIATE_PAGE_LENGTH	: -1
INCLUDE_PRAGMA1	: PRAGMA INCLUDE ("A28006D1.TST")
INCLUDE_PRAGMA2	: PRAGMA INCLUDE ("B28006D1.TST")
INTEGER_FIRST	: -2147483648
INTEGER_LAST	: 2147483647
INTEGER_LAST_PLUS_1	: 2147483648
INTERFACE_LANGUAGE	: AS
LESS_THAN_DURATION	: -75000.0
LESS_THAN_DURATION_BASE_FIRST	: -131073.0
LINE_TERMINATOR	: ' '
LOW_PRIORITY	: 1
MACHINE_CODE_STATEMENT	: AA_INSTR'(AA_EXIT_SUBPRGRM,0,0,0,AA_INSTR_INTG'FIRST,0);
MACHINE_CODE_TYPE	: AA_INSTR
MANTISSA_DOC	: 31
MAX_DIGITS	: 15
MAX_INT	: 2147483647
MAX_INT_PLUS_1	: 2147483648
MIN_INT	: -2147483648

NAME	: NO_SUCH_TYPE_AVAILABLE
NAME_LIST	: DACS_680X0
NAME_SPECIFICATION1	: /home/sun2/ada/68030/test/wrk/X2120A
NAME_SPECIFICATION2	: /home/sun2/ada/68030/test/wrk/X2120B
NAME_SPECIFICATION3	: /home/sun2/ada/68030/test/wrk/X3119A
NEG_BASED_INT	: 16#F000000E#
NEW_MEM_SIZE	: 2097152
NEW_STOR_UNIT	: 8
NEW_SYS_NAME	: DACS_680X0
PAGE_TERMINATOR	: ' '
RECORD_DEFINITION	:
	RECORD INSTR NO: INTEGER; ARG0: INTEGER; ARG1: INTEGER;
	ARG2: INTEGER; ARG3: INTEGER; END RECORD;
RECORD_NAME	: AA_INSTR
TASK_SIZE	: 32
TASK_STORAGE_SIZE	: 1024
TICK	: 0.0208130
VARIABLE_ADDRESS	: FCNDECL.VARIABLE_ADDRESS
VARIABLE_ADDRESS1	: FCNDECL.VARIABLE_ADDRESS1
VARIABLE_ADDRESS2	: FCNDECL.VARIABLE_ADDRESS2
YOUR_PRAGMA	: NOFLOAT

## APPENDIX B

### COMPILATION SYSTEM OPTIONS

The compiler options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to compiler documentation and not to this report.

Invoke the Ada compiler with the following command to the SunOS shell:

```
ada {<option>} <source-spec> {<source-spec>}
```

where the options and parameters are:

<u>QUALIFIER</u>	<u>DESCRIPTION</u>
Specifies program library used.	
-c	CONFIGURATION_FILE. Specifies the file used by the compiler
-l, -L	LIST. Writes a source listing on the list file.
-M	MODE. Protection mode
-n, -N	NOCHECK. Generates run-time constraint checks.
-o, -O	OPTIMIZE. Specifies compiler optimization.
-p	PROGRESS. Displays compiler progress.
-s, -S	NOSAVE. Inserts source text in program library.
-u	UNIT. Assigns a specific unit number to the compilation (must be free and in a sublibrary).
-x	XREF. Creates a cross reference listing.
-d	DEBUG. Generates debug information
<source-spec>	The name of the source file to be compiled

## LINKER OPTIONS

The linker options of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this appendix are to linker documentation and not to this report.

Enter the following command to the SunOS shell to invoke the linker:

```
al (<option>) <unitname>
```

where the options and parameters are:

<u>QUALIFIER</u>	<u>DESCRIPTION</u>
-a	LIBRARY. The library used in the link
-b	RAM_BASE. Base address for RAM sections
-B	ROM_BASE. Base address for ROM sections
-d	DEBUG. Generate debug information
-D	STATISTICS. Print statistics
-e	ENTRY. Alternative program start label
-E	NOEXCEPTIONS. Control of exception management
-f	FLOAT. Control of which float processor is used
-F	CLASS_FILE. Class file name
-g	USER_CONSTANT. User constant sections
-G	SUPERVISOR_CONSTANT. Supervisor constant sections
-H	NOHEAP. Control of memory management
-i	INTERRUPT_STACK. Interrupt stack description
-I	INTERRUPTS. Number of Interrupt Task Control Blocks allocated
-j	USER_CODE. User code sections
-J	SUPERVISOR_CODE. Supervisor code sections
-k	KEEP. Do not delete temporary files
-l	LOGICAL_MEMORY. Logical memory specification
-L	LOG_FILE. Log file name
-m	MAIN_TASK. Main task specification
-M	MODE. Execution mode
-n	OPTION_FILE. Linker option file name
-o	EXECUTABLE. Name of executable file
-O	NOEXECUTABLE. Do not create executable
-p	PHYSICAL_MEMORY. Physical memory specification
-q	RTS_STACK_USE. Amount of memory used by RTS
-r	RAM. Description of RAM memory sections
-R	ROM. Description of ROM memory sections
-s	USER_DATA. User data sections
-S	SUPER_DATA. Supervisor data sections
-t	TASKS. Number of Task Control Blocks allocated
-T	TASK_DEFAULTS. Default values for tasks
-u	UCC_LIBRARY. UCC library name

-U	USR_LIBRARY. A user supplied object library
-V	VERIFY. Print information about the link
-V	MMU_DETAILS. Setup values for MMU registers
-W	WARNINGS. Print warnings
-X	TARGET_OPTIONS. Options to the target linker
-Y	VECTOR. Interrupt vector description
-Y	NOVECTOR. No interrupt vector
-Z	INIT_FILE. Initialization file name
-Z	BOOT. Generate boot module

All qualifier keywords to the options may be abbreviated to the minimal unique substring, and casing is not significant.

## APPENDIX C

### APPENDIX F OF THE Ada STANDARD

The only allowed implementation dependencies correspond to implementation-dependent pragmas, to certain machine-dependent conventions as mentioned in Chapter 13 of the Ada Standard, and to certain allowed restrictions on representation clauses. The implementation-dependent characteristics of this Ada implementation, as described in this Appendix, are provided by the customer. Unless specifically noted otherwise, references in this Appendix are to compiler documentation and not to this report. Implementation-specific portions of the package STANDARD, which are not a part of Appendix F, are:

package STANDARD is

type SHORT\_INTEGER is range -32\_768 .. 32\_767;

type INTEGER is range -2\_147\_483\_648 .. 2\_147\_483\_647;

type FLOAT is digits 6  
range -16#0.FFFF\_FF#E32 .. 16#0.FFFF\_FF#E32;

type LONG\_FLOAT is digits 15  
range -16#0.FFFF\_FFFF\_FFFF\_F8#E256 ..  
16#0.FFFF\_FFFF\_FFFF\_F8#E256;

type DURATION is delta 2#1.0#E-14 range -131\_072.0 .. 131\_071.0;

end STANDARD;



## APPENDIX I. - IMPLEMENTATION DEPENDENT CHARACTERISTICS

---

This appendix describes the implementation-dependent characteristics of DACS-68030 required in Appendix F of the Ada Reference Manual (ANSI/MIL-STD-1815A).

### A. Implementation-Dependent Pragmas

This section describes all implementation defined pragmas.

#### 1. PRAGMA INTERFACE SPELLING

Format:            `pragma     INTERFACE_SPELLING(<subprogram-name>, <string>)`

Placement:        The pragma may be placed as a declarative item.

Restrictions:     Pragma `INTERFACE_SPELLING` must be applied to the subprogram denoted by `<subprogram-name>`. The `<string>` must be a string literal.

This pragma allows an Ada program to call routines with a name that is not a legal Ada name, the `<string>` provides the exact spelling of the name of the procedure.

#### 2. PRAGMA INITIALIZE

Format:            `pragma INITIALIZE(<string_literal>)`

Placement:        The pragma may be placed as a declarative item.

Restrictions:     None.

When the pragma is applied the linker will, as part of the initialization code generate a call to the subprogram with the name `<string_literal>`. The call will be performed before the elaboration of the Ada program is initiated, with IPL on 7. If several pragmas `INITIALIZE` are applied to the same program the routines are called in the elaboration order, if several pragmas `INITIALIZE` are applied to one compilation unit the routines are called in the order of appearance. If several compilations units apply pragma `INITIALIZE` to the same routine the routine is called once only.

### 3. PRAGMA RUNDOWN

Format: `pragma RUNDOWN(<string_literal>)`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Similar to pragma initialize, but the subprogram is called after the main program have terminated and in the reverse order as for the pragma INITIALIZE.

### 4. PRAGMA TASKS

Format: `pragma TASKS;`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Marks the compilation unit with the task attribute. If the code that is interfaced by a pragma INTERFACE uses any tasking constructs, the compilation unit must be marked such that the linker includes the tasking kernel in target programs that reference the compilation unit.

### 5. PRAGMA FLOAT

Format: `pragma FLOAT;`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Marks the compilation unit with the float attribute. If the code that is interfaced by a pragma INTERFACE uses any floating point co-processor instructions, the compilation unit must be marked such that the linker includes initialization of the floating point co-processor in target programs that reference the compilation unit.

### 6. PRAGMA INTERRUPTS

Format: `pragma INTERRUPTS;`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Marks the compilation unit with the interrupt attribute. If the code that is interfaced by a pragma **INTERFACE** uses any interrupts, the compilation unit must be marked such that the linker include the interrupt handling in target programs that reference the compilation unit.

## 7. PRAGMA STORAGE MANAGER

Format: `pragma STORAGE_MANAGER;`

Placement: The pragma may be placed as a declarative item.

Restrictions: None.

Marks the compilation unit with the heap attribute. If the code that is interfaced by a pragma **INTERFACE** uses the storage manager, the compilation unit must be marked such that the linker include initialization of the storage manager in target programs that reference the compilation unit.

## 8. PRAGMA INTERRUPT HANDLER

The pragma **INTERRUPT\_HANDLER** is defined with two formats.

### a. PRAGMA INTERRUPT HANDLER for Task Entries

Format: `pragma INTERRUPT_HANDLER;`

Placement: The pragma must be placed as the first declarative item in the task specification that it applies to.

Restrictions: The task for which the pragma **INTERRUPT\_HANDLER** is applied must fulfill the following requirements:

- An address clause must be specified for all entries to the task.
- All entries of the task must be single entries with no

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~~Parameters.~~

- The entries must not be called from any tasks.
- No other tasks may be specified in the body of the task.
- The body of the task must consist of a single sequence of accept statements for each of the defined interrupts, see below:

```
task body fih is
-- local simple data declaration, no tasks.
begin
    accept handler1 do
        <statementlist>;
    end handler1;
    accept handler2 do
        <statementlist>;
    end handler2;
end fih;
```

- No other tasking construct than unconditional entry calls may appear in the statement list for the select alternatives. The execution of a statement list must only execute one unconditional entry call.
- Any procedures called from the accept body must not use any tasking constructs at all.
- No heap storage must allocated.
- No exception must be propagated out of the statement list of the accept alternatives.

If the restrictions described above are not fulfilled, the program is erroneous and the result of the execution unpredictable. The compiler cannot and is not checking all the restrictions, but attempts to perform as many checks of the requirements as possible.

The pragma `INTERRUPT_HANDLER` with no parameters allows the user to implement immediate response to exceptions.

**b. PRAGMA INTERRUPT\_HANDLER for Procedures**

Format:            p            r            a            g            m            a  
                  `INTERRUPT_HANDLER(procedure-name, integer-literal);`

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**Placement:** The pragma must be placed as a declarative item, in the declarative part, immediately after the procedure specification.

**Restrictions:** The procedure for which pragma **INTERRUPT HANDLER** applies must fulfill the following restrictions:

- The integer-literal must be in range 0..255, and must not define an interrupt vector entry to which the processor may generate a trap.
- The procedure must not be called anywhere in the application.
- No tasks may be declared in the body of the procedure.
- The only tasking construct that may be used from the body of the procedure is unconditional entry calls. Several unconditional entry calls may appear in the body of the procedure but the execution of the body must only lead to the execution of one.
- Any subprograms called from the procedure must not use any tasking constructs at all.
- The procedure must be parameterless.
- No heap storage must allocated from the procedure.
- Exceptions must no be propagated out of the procedure.

If the restrictions described above is not fulfilled the program is erroneous and the result of the execution unpredictable. The compiler cannot and is not checking all the restrictions, but attempts to perform as many checks of the requirements as possible.

The pragma **INTERRUPT HANDLER** for procedures defines the named subprogram to be an interrupt handler for the interrupt vector entry defined by the integer-literal.

## 9. PRAGMA ~~NO~~FLOAT

Format:            **pragma NOFLOAT(task-id)**

Placement:        The pragma must be placed as a declarative item, in the declarative part, defining the task type or object denoted by the task-id.

Restrictions:     The task(s) denoted by the task-id must not execute floating-point co-processor instructions.

This pragma informs the compiler and runtime system that the task will not execute floating point co-processor instructions. Consequently the context switch needs not save and restore the state of the floating point co-processor yielding improved performance.

## 10. PRAGMA SUPERVISOR\_TASK

Format:            **pragma SUPERVISOR\_TASK**

Placement:        The pragma must be placed immediately after the task declaration of the task declaring as a SUPERVISOR\_TASK.

Restrictions:     The pragma has no meaning if linking with BASIC mode.

This pragma informs the compiler and runtime system that the task shall execute at the supervisor privilege level, all other tasks will execute at user privilege level when linking with SECURE execution mode. In BASIC execution mode all tasks execute at the supervisor privilege level.

## 11. PRAGMA ACCESS\_TYPE\_RETAIN\_HEAP

Format:            **pragma ACCESS\_TYPE\_RETAIN\_HEAP**

Placement:        The pragma must be placed as a declarative item, in the declarative part, immediately, after the procedure specification.

Restrictions:     The pragma can only be used when linking in BASIC mode.

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This ~~pragma~~ suppress garbage collection of access types, when leaving the scope of the access type declaration.

### B. Implementation-Dependent Attributes

No implementation-dependent attributes are defined.

### C. Package SYSTEM

package SYSTEM is

type ADDRESS	is new	INTEGER;
subtype PRIORITY	is	INTEGER range 1 .. 24;
type NAME	is	( DACS_680X0 );
SYSTEM_NAME:	constant	NAME := DACS_680X0;
STORAGE_UNIT:	constant	:= 8;
MEMORY_SIZE:	constant	:= 2#1#E32;
MIN_INT:	constant	:= -2_147_483_648;
MAX_INT:	constant	:= 2_147_483_647;
MAX_DIGITS:	constant	:= 15;
MAX_MANTISSA:	constant	:= 31;
 FINE_DELTA:	 constant	 := 2#1.0#E-31;
TICK:	constant	:= 0.0208130;

type interface\_language is (AS,C);

end SYSTEM;

### D. Representation Clauses

The DACS-68030 fully supports the 'SIZE representation for derived types. The representation clauses that are accepted for non-derived types are described in the following subsections.

#### 1. Length Clause

Some remarks on implementation dependent behavior of length clauses are necessary:

- ~~When~~ using the `SIZE` attribute for discrete types, the maximum value that can be specified is 32 bits.
- `SIZE` is only obeyed for discrete types when the type is a part of a composite object, e.g. arrays or records.
- Using the `STORAGE_SIZE` attribute for a collection will set an upper limit on the total size of objects allocated in this collection. If further allocation is attempted, the exception `STORAGE_ERROR` is raised.
- When `STORAGE_SIZE` is specified in a length clause for a task, the process stack area will be of the specified size.

## 2. Enumeration Representation Clauses

Enumeration representation clauses may specify representations in the range of `INTEGER'FIRST + 1..INTEGER'LAST - 1`.

## 3. Record Representation Clauses

When representation clauses are applied to records the following restrictions are imposed:

- if the component is a record or an unpacked array, it must start at a storage unit boundary (32 bits)
- a record occupies an integral number of storage units (words) (even though a record may have fields that only define an odd number of bytes)
- a record may take up a maximum of 2 giga bits
- a component must be specified with its proper size (in bits), regardless of whether the component is an array or not.
- if a non-array component has a size which equals or exceeds one storage unit 32-bits the component must start on a storage unit boundary.
- the elements in an array component should always be wholly contained in 32-bits.



If the ~~record~~ type contains components which are not covered by a component clause, they are allocated consecutively after the component with the value. Allocation of a record component without a component clause is always aligned on a storage unit boundary. Holes created because of component clauses are not otherwise utilized by the compiler.

Pragma PACK on a record type will attempt to pack the components not already covered by a representation clause (perhaps none). This packing will begin with the small scalar components and larger components will follow in the order specified in the record. The packing begins at the first storage unit after the components with representation clauses.

#### a. Alignment Clauses

Alignment clauses for records are implemented with the following characteristics:

- If the declaration of the record type is done at the outermost level in a library package, any alignment is accepted.
- If the record declaration is done at a given static level (higher than the outermost library level, i.e., the permanent area), only word alignments are accepted.
- Any record object declared at the outermost level in a library package will be aligned according to the alignment clause specified for the type. Record objects declared elsewhere can only be aligned on a word boundary. If the record type is associated with a different alignment, an error message will be issued.
- If a record type with an associated alignment clause is used in a composite type, the alignment is required to be one word; an error message is issued if this is not the case.

#### E. Implementation-Dependent Names for Implementation-Dependent Components

None defined by the compiler.

## F. Address Clauses

This section describes the implementation of address clauses and what types of entities may have their address specified by the user.

### 1. Objects

Address clauses are supported for scalar and composite objects whose size can be determined at compile time if the address is specified.

### 2. Task Entries

Address clauses are supported for task entries. The following restrictions applies:

- The affected entries must be defined in a task object only, not a task type.
- The entries must be single and parameterless.
- The address specified must not denote an interrupt index which the processor may trap.
- If the interrupt entry executes floating point co-processor instructions the state of the co-processor must be saved prior to execution of any floating point instructions, and restore before the return.

The address specified in the address clause denotes the interrupt vector index.

## G. Input/Output Packages

In many embedded systems, there is no need for a traditional I/O system, but in order to support testing and validation, DDC-I has developed a small terminal oriented I/O system. This I/O system consists essentially of `TEXT_IO` adapted with respect to handling only a terminal and not file I/O (file I/O will cause a `USE ERROR` to be raised) and a low level package called `TERMINAL_DRIVER`. A

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~~BASIC\_IO~~ package has been provided for convenience purposes, forming an interface between `TEXT_IO` and `TERMINAL_DRIVER` as illustrated in the following figure.

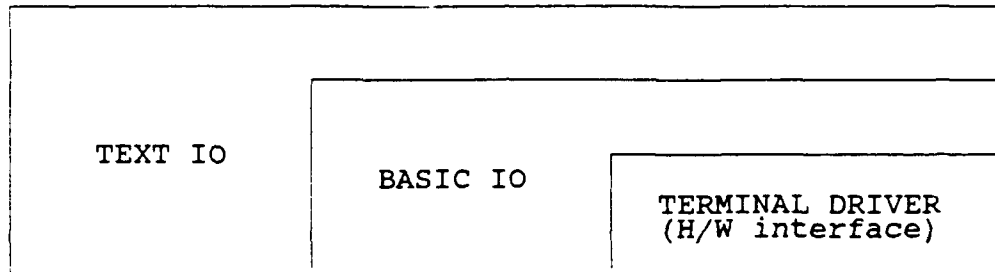


Fig. F.1:

The `TERMINAL_DRIVER` package is the only package that is target dependent, i.e., it is the only package that need be changed when changing communications controllers. The actual body of the `TERMINAL_DRIVER` is written in assembly language, but an Ada interface to this body is provided. A user can also call the terminal driver routines directly, i.e. from an assembly language routine. `TEXT_IO` and `BASIC_IO` are written completely in Ada and need not be changed.

`BASIC_IO` provides a mapping between `TEXT_IO` control characters and ASCII as follows:

TEXT IO	ASCII Character
LINE TERMINATOR	ASCII.CR
PAGE TERMINATOR	ASCII.FF
FILE TERMINATOR	ASCII.EM (ctrl Z)
NEW LINE	ASCII.LF

Table F.1: Mapping between `TEXT_IO` and ASCII

The services provided by the terminal driver are:

- 1) Reading a character from the communications port.
- 2) Writing a character to the communications port.

## 1. Package `TEXT_IO`

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The specification of package TEXT\_IO:

```
pragma page;
with BASIC_IO;

with IO_EXCEPTIONS;
package TEXT_IO is

    type FILE_TYPE is limited private;

    type FILE_MODE is (IN_FILE, OUT_FILE);

    type COUNT is range 0 .. INTEGER'LAST;
    subtype POSITIVE_COUNT is COUNT range 1 .. COUNT'LAST;
    UNBOUNDED: constant COUNT:= 0; -- line and page length

    -- max. size of an integer output field 2#....#
    subtype FIELD is INTEGER range 0 .. 35;

    subtype NUMBER_BASE is INTEGER range 2 .. 16;

    type TYPE_SET is (LOWER_CASE, UPPER_CASE);
pragma PAGE;
    -- File Management
    procedure CREATE (FILE : in out FILE_TYPE;
                     MODE : in FILE_MODE :=OUT_FILE;
                     NAME : in STRING :="";
                     FORM : in STRING :=""
                     );

    procedure OPEN (FILE : in out FILE_TYPE;
                   MODE : in FILE_MODE;
                   NAME : in STRING;
                   FORM : in STRING :=""
                   );

    procedure CLOSE (FILE : in out FILE_TYPE);
    procedure DELETE (FILE : in out FILE_TYPE);
    procedure RESET (FILE : in out FILE_TYPE;
                     MODE : in FILE_MODE);
    procedure RESET (FILE : in out FILE_TYPE);

    function MODE (FILE : in FILE_TYPE) return FILE_MODE;
    function NAME (FILE : in FILE_TYPE) return STRING;
    function FORM (FILE : in FILE_TYPE) return STRING;

    function IS_OPEN(FILE : in FILE_TYPE return BOOLEAN;
```

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```
pragma PAGE;--
-- control of default input and output files

procedure SET_INPUT  (FILE : in FILE_TYPE);
procedure SET_OUTPUT (FILE : in FILE_TYPE);

function STANDARD_INPUT  return FILE_TYPE;
function STANDARD_OUTPUT return FILE_TYPE;

function CURRENT_INPUT  return FILE_TYPE;
function CURRENT_OUTPUT return FILE_TYPE;
pragma PAGE;
-- specification of line and page lengths

procedure SET_LINE_LENGTH (FILE : in FILE_TYPE;
                           TO   : in COUNT);
procedure SET_LINE_LENGTH (TO : in COUNT);

procedure SET_PAGE_LENGTH (FILE : in FILE_TYPE;
                           TO   : in COUNT);
procedure SET_PAGE_LENGTH (TO : in COUNT);

function LINE_LENGTH (FILE : in FILE_TYPE)
  return COUNT;
function LINE_LENGTH return COUNT;

function PAGE_LENGTH (FILE : in FILE_TYPE)
  return COUNT;
function PAGE_LENGTH return COUNT;
```

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pragma ~~PAGE~~;

-- Column, Line, and Page Control

```
procedure NEW_LINE (FILE : in FILE_TYPE;  
                   SPACING : in POSITIVE_COUNT := 1);  
procedure NEW_LINE (SPACING : in POSITIVE_COUNT := 1);  
  
procedure SKIP_LINE (FILE : in FILE_TYPE;  
                   SPACING : in POSITIVE_COUNT := 1);  
procedure SKIP_LINE (SPACING : in POSITIVE_COUNT := 1);  
  
function  END_OF_LINE (FILE : in FILE_TYPE) return BOOLEAN;  
function  END_OF_LINE                                     return BOOLEAN;  
  
procedure NEW_PAGE    (FILE : in FILE_TYPE);  
procedure NEW_PAGE;  
  
procedure SKIP_PAGE   (FILE : in FILE_TYPE);  
procedure SKIP_PAGE;  
  
function  END_OF_PAGE (FILE : in FILE_TYPE) return BOOLEAN;  
function  END_OF_PAGE                                     return BOOLEAN;  
  
function  END_OF_FILE (FILE : in FILE_TYPE) return BOOLEAN;  
function  END_OF_FILE                                     return BOOLEAN;  
  
procedure SET_COL      (FILE : in FILE_TYPE;  
                       TO   : in POSITIVE_COUNT);  
procedure SET_COL      (TO   : in POSITIVE_COUNT);  
  
procedure SET_LINE     (FILE : in FILE_TYPE;  
                       TO   : in POSITIVE_COUNT);  
procedure SET_LINE     (TO   : in POSITIVE_COUNT);  
  
function  COL           (FILE : in FILE_TYPE)  
                       return POSITIVE_COUNT;  
function  COL           return POSITIVE_COUNT;  
  
function  LINE           (FILE : in FILE_TYPE)  
                       return POSITIVE_COUNT;  
function  LINE           return POSITIVE_COUNT;  
  
function  PAGE           (FILE : in FILE_TYPE)  
                       return POSITIVE_COUNT;  
function  PAGE           return POSITIVE_COUNT;
```

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pragma PAGE;--

-- Character Input-Output

```
procedure GET  (FILE : in FILE_TYPE; ITEM : out CHARACTER);
procedure GET  (                ITEM : out CHARACTER);
procedure PUT  (FILE : in FILE_TYPE; ITEM : in CHARACTER);
procedure PUT  (                ITEM : in CHARACTER);
```

-- String Input-Output

```
procedure GET  (FILE : in FILE_TYPE; ITEM : out CHARACTER);
procedure GET  (                ITEM : out CHARACTER);
procedure PUT  (FILE : in FILE_TYPE; ITEM : in CHARACTER);
procedure PUT  (                ITEM : in CHARACTER);
```

```
procedure GET_LINE  (FILE : in FILE_TYPE;
                    ITEM : out STRING;
                    LAST : out NATURAL);
```

```
procedure GET_LINE  (ITEM : out STRING;
                    LAST : out NATURAL);
```

```
procedure PUT_LINE  (FILE : in FILE_TYPE;
                    ITEM : in STRING);
procedure PUT_LINE  (ITEM : in STRING);
```

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pragma ~~PAGE~~;

-- Generic Package for Input-Output of Integer Types

generic

type NUM is range <>;

package INTEGER\_IO is

    DEFAULT\_WIDTH : FIELD := NUM'WIDTH;

    DEFAULT\_BASE : NUMBER\_BASE := 10;

    procedure GET (FILE : in FILE\_TYPE;  
                  ITEM : out NUM;  
                  WIDTH : in FIELD := 0);

    procedure GET (ITEM : out NUM;  
                  WIDTH : in FIELD := 0);

    procedure PUT (FILE : in FILE\_TYPE;  
                  ITEM : in NUM;  
                  WIDTH : in FIELD := DEFAULT\_WIDTH;  
                  BASE : in NUMBER\_BASE := DEFAULT\_BASE);

    procedure PUT (ITEM : in NUM;  
                  WIDTH : in FIELD := DEFAULT\_WIDTH;  
                  BASE : in NUMBER\_BASE := DEFAULT\_BASE);

    procedure GET (FROM : in STRING;  
                  ITEM : out NUM;  
                  LAST : out POSITIVE);

    procedure PUT (TO : out STRING;  
                  ITEM : in NUM;  
                  BASE : in NUMBER\_BASE := DEFAULT\_BASE);

end INTEGER\_IO;



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pragma PAGE;

-- Generic Packages for Input-Output of Real Types

generic

type NUM is digits <>;

package FLOAT\_IO is

DEFAULT\_FORE : FIELD := 2;

DEFAULT\_AFT : FIELD := NUM'DIGITS - 1;

DEFAULT\_EXP : FIELD := 3;

procedure GET (FILE : in FILE\_TYPE;  
ITEM : out NUM;  
WIDTH : in FIELD := 0);

procedure GET (ITEM : out NUM;  
WIDTH : in FIELD := 0);

procedure PUT (FILE : in FILE\_TYPE;  
ITEM : in NUM;  
FORE : in FIELD := DEFAULT\_FORE;  
AFT : in FIELD := DEFAULT\_AFT;  
EXP : in FIELD := DEFAULT\_EXP);

procedure PUT (ITEM : in NUM;  
FORE : in FIELD := DEFAULT\_FORE;  
AFT : in FIELD := DEFAULT\_AFT;  
EXP : in FIELD := DEFAULT\_EXP);

procedure GET (FROM : in STRING;  
ITEM : out NUM;  
LAST : out POSITIVE);

procedure PUT (TO : out STRING;  
ITEM : in NUM;  
AFT : in FIELD := DEFAULT\_AFT;  
EXP : in FIELD := DEFAULT\_EXP);

end FLOAT\_IO;

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pragma PAGE;

generic

type NUM is delta <>;

package FIXED\_IO is

DEFAULT\_FORE : FIELD := NUM'FORE;

DEFAULT\_AFT : FIELD := NUM'AFT;

DEFAULT\_EXP : FIELD := 0;

procedure GET (FILE : in FILE\_TYPE;  
ITEM : out NUM;  
WIDTH : in FIELD := 0);

procedure GET (ITEM : out NUM;  
WIDTH : in FIELD := 0);

procedure PUT (FILE : in FILE\_TYPE;  
ITEM : in NUM;  
FORE : in FIELD := DEFAULT\_FORE;  
AFT : in FIELD := DEFAULT\_AFT;  
EXP : in FIELD := DEFAULT\_EXP);

procedure PUT (ITEM : in NUM;  
FORE : in FIELD := DEFAULT\_FORE;  
AFT : in FIELD := DEFAULT\_AFT;  
EXP : in FIELD := DEFAULT\_EXP);

procedure GET (FROM : in STRING;  
ITEM : out NUM;  
LAST : out POSITIVE);

procedure PUT (TO : out STRING;  
ITEM : in NUM;  
AFT : in FIELD := DEFAULT\_AFT;  
EXP : in FIELD := DEFAULT\_EXP);

end FIXED\_IO;

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```
pragma PAGE;
-- Generic Package for Input-Output of Enumeration Types

generic
  type ENUM is (<>);
package ENUMERATION_IO is

  DEFAULT_WIDTH   : FIELD   := 0;
  DEFAULT_SETTING : TYPE_SET := UPPER_CASE;

  procedure GET (FILE : in FILE_TYPE; ITEM : out ENUM);
  procedure GET (ITEM : out ENUM);

  procedure PUT (FILE : FILE_TYPE;
                 ITEM : in ENUM;
                 WIDTH : in FIELD   := DEFAULT_WIDTH;
                 SET   : in TYPE_SET := DEFAULT_SETTING);
  procedure PUT (ITEM : in ENUM;
                 WIDTH : in FIELD   := DEFAULT_WIDTH;
                 SET   : in TYPE_SET := DEFAULT_SETTING);

  procedure GET (FROM : in STRING;
                 ITEM : out ENUM;
                 LAST : out POSITIVE);

  procedure PUT (TO : out STRING;
                 ITEM : in ENUM;
                 SET : in TYPE_SET := DEFAULT_SETTING);

end ENUMERATION_IO;

pragma PAGE;

-- Exceptions

STATUS_ERROR : exception renames IO_EXCEPTIONS.STATUS_ERROR;
MODE_ERROR   : exception renames IO_EXCEPTIONS.MODE_ERROR;
NAME_ERROR   : exception renames IO_EXCEPTIONS.NAME_ERROR;
USE_ERROR    : exception renames IO_EXCEPTIONS.USE_ERROR;
DEVICE_ERROR : exception renames IO_EXCEPTIONS.DEVICE_ERROR;
END_ERROR    : exception renames IO_EXCEPTIONS.END_ERROR;
DATA_ERROR   : exception renames IO_EXCEPTIONS.DATA_ERROR;
LAYOUT_ERROR : exception renames IO_EXCEPTIONS.LAYOUT_ERROR;
```

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```
pragma page;
private

    type FILE_TYPE is
    record
        FT : INTEGER := -1;
    end record;

end TEXT_IO;
```

## 2. Package IO EXCEPTIONS

The specification of the package IO\_EXCEPTIONS:

```
package IO_EXCEPTIONS is

    STATUS_ERROR : exception;
    MODE_ERROR   : exception;
    NAME_ERROR   : exception;
    USE_ERROR    : exception;
    DEVICE_ERROR : exception;
    END_ERROR    : exception;
    DATA_ERROR  : exception;
    LAYOUT_ERROR : exception;

end IO_EXCEPTIONS;
```

## 3. Package BASIC IO

The specification of package BASIC\_IO:

```
with IO_EXCEPTIONS;

package BASIC_IO is

    type count is range 0 .. integer'last;

    subtype positive_count is count range 1 .. count'last;

    function get_integer return string;

    -- Skips any leading blanks, line terminators or page
    -- terminators. Then reads a plus or a minus sign if
```

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```
-- present, then reads according to the syntax of an
-- integer literal, which may be based. Stores in item
-- returns a string containing an optional sign and an
-- integer literal.
--
-- The exception DATA_ERROR is raised if the sequence
-- of characters does not correspond to the syntax
-- described above.
--
-- The exception END_ERROR is raised if the file terminator
-- is read. This means that the starting sequence of an
-- integer has not been met.
--
-- Note that the character terminating the operation must
-- be available for the next get operation.
--

function get_real return string;

-- Corresponds to get_integer except that it reads according
-- to the syntax of a real literal, which may be based.

function get_enumeration return string;

-- Corresponds to get_integer except that it reads according
-- to the syntax of an identifier, where upper and lower
-- case letters are equivalent to a character literal
-- including the apostrophes.

function get_item (length : in      integer) return string;

-- Reads a string from the current line and stores it in
-- item. If the remaining number of characters on the
-- current line is less than length then only these
-- characters are returned. The line terminator is not
-- skipped.

procedure put_item (item : in      string);

-- If the length of the string is greater than the current
-- maximum line (linelength), the exception LAYOUT_ERROR
-- is raised.
--
-- If the string does not fit on the current line a line
-- terminator is output, then the item is output.

-- Line and page lengths - [DOD-83] 14.3.3.
--
```

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```
procedure set_line_length (to : in count);
procedure set_page_length (to : in count);
function line_length return count;
function page_length return count;
-- Operations on columns, lines and pages - [DOD-83] 14.3.4.
--
procedure new_line;
procedure skip_line;
function end_of_line return boolean;
procedure new_page;
procedure skip_page;
function end_of_page return boolean;
function end_of_file return boolean;
procedure set_col (to : in positive_count);
procedure set_line (to : in positive_count);
function col return positive_count;
function line return positive_count;
function page return positive_count;
-- Character and string procedures.
-- Corresponds to the procedures defined in [DOD-83] 14.3.6.
procedure get_character (item : out character);
procedure get_string (item : out string);
procedure get_line (item : out string;
                    last : out natural);
procedure put_character (item : in character);
procedure put_string (item : in string);
```

```
procedure put_line (item : in      string);

-- exceptions:

USE_ERROR      : exception renames IO_EXCEPTIONS.USE_ERROR;
DEVICE_ERROR   : exception renames IO_EXCEPTIONS.DEVICE_ERROR;
END_ERROR      : exception renames IO_EXCEPTIONS.END_ERROR;
DATA_ERROR     : exception renames IO_EXCEPTIONS.DATA_ERROR;
LAYOUT_ERROR   : exception renames IO_EXCEPTIONS.LAYOUT_ERROR;

end BASIC_IO;
```

#### 4. Package TERMINAL DRIVER

The specification of package TERMINAL\_DRIVER:

```
package terminal_driver is

  procedure put_character(ch : character);

  procedure flush;

  function get_character return character;

  procedure purge;

private

  pragma interface (AS, put_character);
  pragma interface_spelling(put_character, "Ada_UCC_G$PutByte");

  pragma interface (AS, get_character);
  pragma interface_spelling(get_character, "Ada_UCC_G$GetByte");

  pragma interface (AS, flush);
  pragma interface_spelling(flush, "Ada_UCC_G$FlushOutput");

  pragma interface (AS, purge);
  pragma interface_spelling(purge, "Ada_UCC_G$PurgeInput");

  pragma initialize("Ada_UCC_G$InitIO");
  pragma rundown   ("Ada_UCC_G$CloseIO");

end terminal_driver;
```

## 5. Package ~~SE~~SEQUENTIAL IO

The specification of package SEQUENTIAL\_IO:

-- Source code for SEQUENTIAL\_IO

pragma PAGE;

with IO\_EXCEPTIONS;

generic

    type ELEMENT\_TYPE is private;

package SEQUENTIAL\_IO is

    type FILE\_TYPE is limited private;

    type FILE\_MODE is (IN\_FILE, OUT\_FILE);



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pragma PAGE;

-- File management

```
procedure CREATE(FILE : in out FILE_TYPE;
                 MODE : in      FILE_MODE := OUT_FILE;
                 NAME : in      STRING    := "";
                 FORM : in      STRING    := "");

procedure OPEN  (FILE : in out FILE_TYPE;
                 MODE : in      FILE_MODE;
                 NAME : in      STRING;
                 FORM : in      STRING := "");

procedure CLOSE (FILE : in out FILE_TYPE);

procedure DELETE(FILE : in out FILE_TYPE);

procedure RESET (FILE : in out FILE_TYPE;
                 MODE : in      FILE_MODE);

procedure RESET (FILE : in out FILE_TYPE);

function MODE    (FILE : in FILE_TYPE) return FILE_MODE;

function NAME    (FILE : in FILE_TYPE) return STRING;

function FORM    (FILE : in FILE_TYPE) return STRING;

function IS_OPEN(FILE : in FILE_TYPE) return BOOLEAN;
```

pragma PAGE;

-- input and output operations

```
procedure READ  (FILE : in      FILE_TYPE;
                 ITEM : out     ELEMENT_TYPE);

procedure WRITE (FILE : in FILE_TYPE;
                 ITEM : in  ELEMENT_TYPE);

function END_OF_FILE(FILE : in FILE_TYPE) return BOOLEAN;
```

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```
pragma PAGE;  
-- exceptions
```

```
STATUS_ERROR : exception renames IO_EXCEPTIONS.STATUS_ERROR;  
MODE_ERROR   : exception renames IO_EXCEPTIONS.MODE_ERROR;  
NAME_ERROR   : exception renames IO_EXCEPTIONS.NAME_ERROR;  
USE_ERROR    : exception renames IO_EXCEPTIONS.USE_ERROR;  
DEVICE_ERROR : exception renames IO_EXCEPTIONS.DEVICE_ERROR;  
END_ERROR    : exception renames IO_EXCEPTIONS.END_ERROR;  
DATA_ERROR   : exception renames IO_EXCEPTIONS.DATA_ERROR;
```

```
pragma PAGE;  
private
```

```
    type FILE_TYPE is new INTEGER;
```

```
end SEQUENTIAL_IO;
```

#### H. Machine Code Insertions

Machine code insertion is allowed using the instruction defined in package MACHINE\_CODE. All arguments given in the code statement aggregate must be static.

The machine language defined in package MACHINE\_CODE is not 68020 assemble, but rather Abstract A-code which is an intermediate language used by the compiler.